

Sex differences in tissue composition in female and male *Pan paniscus* with comparison to other hominoids. R.K. McFARLAND and A.L. ZIHLMAN, Anthropology, University of California, Santa Cruz, 95064.

Pan paniscus (pygmy chimpanzee or bonobo), along with *Pan troglodytes*, is most closely related to humans and is of considerable interest in the study of human origins.

Although the hominoid skeleton has been well studied, much less is known about soft tissue, e.g. muscle and fat. Studies of human body composition document major differences in proportions of muscle and fat between adult women and men: e.g. women 37% muscle, 28% fat; men, 43% muscle, 17% fat. Little is known about the pattern in other hominoids.

We present data based on dissection of entire animals: 5 adult *Pan paniscus* and 4 adult *Gorilla gorilla*. Relative to total body mass, the *Pan paniscus* female has 33% muscle, whereas males have 45% muscle. Both sexes have little body fat, less than 5%. Gorillas, on the other hand, show little difference in proportion of muscle: the female 38%, the males, 37%. Although body fat is similar in both sexes, overall, gorillas have more fat than *Pan paniscus*, about 10%. *Pan paniscus* approaches the human pattern of sex differences in muscle proportions, but has much less body fat overall and little sex difference. Studies of soft tissue contribute to the understanding of sex differences in living hominoids and must be taken into account when interpreting sex differences in fossil hominids.

Survey of endangered monkeys in the forest reserves of eastern Cote d'Ivoire. W.S. MCGRAW, Department of Anatomy, New York College of Osteopathic Medicine, Old Westbury, New York, 11568.

Recent surveys of the Upper Guinea East subregion revealed that three primates, *Cercopithecus diana roloway* Schreber 1774, *Procolobus badius waldroni* Hayman 1936 and *Cercocebus atys lunulatus* Temminck 1853 were facing extinction in southwestern Ghana (Struhsaker and Oates 1995). Primates of this subregion have historically ranged into eastern Cote d'Ivoire however, prior to this project, the status of the cercopithecoid monkeys in the western portion of this area was unknown.

This paper reports on a survey carried out in selected forest reserves between March 10th and May 1st, 1997. Satellite image photographs (LANDSAT) were studied to locate forest blocks possibly containing

monkeys. Using a variety of surveying techniques, four areas were investigated: the Bossemattie, Songan, Mabi and Yaya reserves. Additional inquiries about the availability of bush meat were made in surrounding villages.

Survey results indicate that *Cercopithecus campbelli* and *Cercopithecus petaurista* are the most abundant monkeys and perhaps the only species still in viable populations in the forest reserves of eastern Cote d'Ivoire. *Procolobus verus* and *Colobus vellerosus* can still be found, but at very low densities. *Cercopithecus diana* and *Cercopithecus atys* are also present, however not in numbers approaching those necessary for sustainable populations. No evidence of *Procolobus badius waldroni* was found and it is very likely that this monkey has recently gone extinct. The greatest threat to the remaining primates is hunting rather than habitat destruction. The status of "foret classée" (forest reserve) does little to protect the existing forest in eastern Cote d'Ivoire and without immediate action, all fauna still ranging within these reserves will be eliminated.

Financial support was provided by the Royal Zoological Society of Scotland, Conservation International, Primate Conservation Incorporated, Wildlife Conservation International and the Chicago Zoological Society.

Manual laterality in anvil use: Wild chimpanzees (*Pan troglodytes*) cracking *Strychnos* fruits. W.C. MCGREW and L.F. MARCHANT, Anthropology, Miami University, Oxford, OH 45056; R.W. WRANGHAM, Anthropology, Harvard University, Cambridge, MA 02138; H. KLEIN, 643 East Lake Sammanish NE, Redmond, WA 98053.

Wild chimpanzees (*Pan troglodytes schweinfurthii*) of Gombe National Park, Tanzania, smash open the hard-shelled fruits of *Strychnos* spp. (Loganiaceae) on anvils of stone or woody vegetation. This percussive technique of extractive foraging (that yields an edible pulp) requires both strength and skill. Of the 14 individuals for whom enough data were available, nine showed exclusive use of one hand or the other, that is the greatest individual hand preferences, for this food processing task. Three others were significantly but not exclusively lateralized, but there was no overall bias to the left or right side, across individuals.

Such exclusive laterality of manual functioning corresponds to Level 3 on a five-level model of lateralization that appears to reflect the increasingly demanding sensory-motor skills of object manipulation. (McGrew & Marchant, Yearb. Phys. Anthropol. 40, in press). (In Level 1 laterality, left and right hands are used interchangeably; at Level 2, individuals are biased to left or right, but not exclusively so; at Level 4, there is a population-level shift, in which most members are biased to one side

or the other; at Level 5, most members of a population exclusively use the same hand for a task or set of tasks.)

Level 3 laterality is the norm for wild chimpanzees using tools in subsistence activities, whether this be nut cracking with a hammer and anvil or termite fishing with a flexible probe. At Gombe there is precise congruence between the hand favored in termite fishing and in anvil use, in almost all cases.

This research was funded by the W.T. Grant Foundation and the LSB Leakey Foundation.

Assessment of error and bias in age estimation.

A.H. MCKEOWN, N.P. HERRMANN and L. MEADOWS JANTZ, Department of Anthropology, University of Tennessee, Knoxville 37996-0720

Whether a researcher is approaching human skeletal material from the paleodemographic or forensic perspective, age-at-death is a critical parameter. Recent research has engendered an ongoing debate regarding the utility of age estimation as applied in paleodemographic reconstructions and individual assessments. In an investigation of various issues surrounding this debate, we evaluated the age data from the Forensic Data Bank (FDB) maintained at the University of Tennessee, Knoxville. While our study revealed a bias pattern documented by other researchers, the pelvic age indicators demonstrate remarkably high correlations between age-at-death estimates and known age (ranging from $r=0.934$ to $r=0.724$). On the surface, these results suggest that when applied to a relatively young sample (mean age-at-death of 41 years) pelvic aging methods are more accurate than previously thought. However, the correlations among age indicators are also relatively high when compared to previous studies, indicating potential bias in the assessment process.

To address these issues, we present results from a series of tests involving the pubic symphysis and auricular surface methods. The study sample consists of all appropriate individuals in the William M. Bass Forensic and Donated Collections ($N=169$) from which a subsample is derived utilizing the age profile of the FDB. All available age indicators from each individual were independently assessed by two observers in order to determine the rate of interobserver error. To investigate potential bias factors, the same two observers re-evaluated age indicators in the presence of other primary and secondary indicators when available. Results demonstrate that scoring of individual age indicators is influenced by the presence of other indicators. The implications of our findings regarding the employment of these methods for paleodemographic purposes will also be discussed.

Analysis of the Taylor Farm Site (ca. A.D. 950-1670). Pitfalls of curation and paleopathological possibilities. E.M. MC NAMARA, T.L. JOLLY, Department of Anthropology, University of Illinois, Urbana, IL 61801, and A.L. GRAUER, Department of Sociology and Anthropology, Loyola University Chicago, IL 60626.

The Taylor Farm site from the Little Miami River valley in Southeastern Ohio was excavated in 1891. It is a component of the Anderson Focus of the Fort Ancient culture estimated to be A.D. 950-1670. Housed at the Field Museum of Natural History in Chicago, the skeletal material, predominately composed of crania, appears to be only a portion of the remains from the original excavation. In this paper, we investigate the representativeness of the museum sample as compared to reports of the original excavation as well as examine the patterns of health and disease in this culturally complex population.

The results of the analysis yielded a sample of 33 individuals: 27 (82%) adults, 5 (15%) subadults, and one of indeterminable age. Of the adults that could be confidently assigned a sex, 7/15 (47%) were female and 8/15 (53%) were male. Most of the paleopathological data focused upon the presence of cranial lesions, which suggested that 32% (8/25) of the population displayed porotic hyperostosis; 64% (16/25) of the population displayed linear enamel hypoplasias; 52% (13/25) displayed caries; and 45.5% (10/22) displayed antemortem tooth loss. It appears that postcranial pathological conditions were not uncommon in individuals with the requisite anatomical features: 26.7% (4/15) displayed periosteal reactions; 8.3% (1/12) displayed kyphosis; 16.7% (2/12) displayed Schmorl's Nodes; 58.3% (7/12) displayed osteophytosis; and 8.3% (1/12) displayed ligamentary exostosis.

The high percentage of individuals displaying cranial and postcranial lesions is discussed and compared to other populations in the region as a means towards understanding why stressors were so common in these people. This project is supported by NSF Grant No. SBR-9350256.

Questioning evolution: Teaching what we don't know. R.J. MEIER, Anthropology, Indiana University-Bloomington, IN 47405.

The predominant teaching approach in American education is knowledge-based. Students are customarily presented with thoroughly tested ideas and generally accepted sets of facts. This is true for biology overall, and for evolution in particular. In a survey of widely adopted textbooks in basic biology it was found that very little question was raised concerning the course of organic

evolution or the timing and rate at which it occurred. A criticism often leveled by creationists is that only evidence for evolution in presented in the classroom. On the other hand, there has been a concerted effort among educators to develop critical thinking skills among students. Students are encouraged to evaluate evidence and are expected to be able to sort through alternative explanations and possibly conflicting theories. In applying this notion to evolution, there is no better reference than Darwin himself who devoted a full chapter, plus portions of several others in the *Origin of Species*, to pointedly and exhaustively question his theory of descent with modification, that is, natural selection. Darwin's caution may have anticipated the antithesis of knowledge-based learning, labeled as ignorance-based instruction. Uncertainty, incompleteness, and questioning are hallmarks of this approach. This paper argues that it would be both scientifically sound and educationally stimulating to produce textbooks, course materials and laboratory exercises that not only "teach the facts", but promote the learning of what presently is incompletely known or actively debated. An example of this kind of lesson using radiometric dating of the fossil record is presented.

Midtarsal flexibility in ape foot dynamics, early hominid footprints and bipedalism. D.J. MELDRUM, Dept. Biological Sciences, Idaho State University, Pocatello, ID 83209-8007. R.E. WUNDERLICH, Center for Locomotion Studies, Penn State University, University Park, PA 16802.

As early as 1935, Elftman & Manter noted themidtarsal flexibility present in chimpanzees and contrasted it with the comparatively rigid platform of the human foot. The dorsiflexion of the heel segment at the transverse tarsal joint was referred to as the "midtarsal break." It permits the independent actions of the grasping forefoot and the levering hindfoot during climbing. At some point after the transition to habitual bipedalism, the ape grasp-climb adaptation and midfoot flexibility were lost, thereby increasing the mechanical advantage of the ankle plantarflexors. This improved the efficiency and economy of distance walking and running. Others have subsequently made note of this distinction of the ape foot, but the kinematics and correlated tarsal relationships of the midtarsal break have received limited consideration.

We set out to characterize the midtarsal break using several methods. We videographed two chimpanzees and humans during bipedal and quadrupedal (chimpanzee) locomotion with simultaneous lateral, plantar and fore-aft views and recorded the distribution and magnitude of plantar pressures. Lateral and A-P radiographs of the foot of one anesthetized chimpanzee were used to visualize tarsal relationships through the range of midfoot movements. Ape and human footprints were examined to document the potential effects of a midtarsal break on footprint configuration.

During stance phase of chimpanzee bipedalism and bipedalism, a pronounced dorsiflexion of the hindfoot accompanies high midfoot peak plantar pressures, relative to those observed in human bipedalism. Radiographs indicate that the flexion of the midtarsal region occurs primarily at the talonavicular joint and to a lesser degree at the calcaneocuboid

joint. High midfoot pressures during the midtarsal break are often indicated by a pressure ridge in chimpanzee footprints, not observed in human prints. Our data provide a novel perspective on the interpretation of the often controversial Laetoli trackway, the oldest direct evidence of hominid bipedalism. Preliminary examination suggests evidence of a relatively ape-like midtarsal flexibility and the lack of a consistently present longitudinal arch.

Supported by a grant from the ISU Faculty Research Committee, NSF grants SBR 957078 and 952036, the LSB Leakey Foundation and Sigma Xi.

Mitochondrial DNA D-loop sequence variation within and between Yanomami villages. D. A. MERRIWETHER (Michigan), K. Green (Michigan), D. E. Crews (Ohio State), and J. V. NEEL (Michigan)

Blood was drawn on over 3000 Yanomami from 52 villages in Brazil between 1966 and 1976 by the Neel lab, and from 100 individuals from ten Yanomami villages in the 1990s by the Crews lab. DNA was extracted over the last three years, and mtDNA and Y chromosome typing has proceeded on the unrelated individuals from this sample. Mitochondrial DNA D-Loop sequence variation (nts 15975-00048 and 00008-00430 were amplified and sequenced in both directions on an ABI 377XL automated sequencer) was collected and examined in a subset of these villages and samples. Expansion times (using pairwise sequence distance distributions), gene flow (using Maddison and Slatkin's cladistic approach), and heterozygosity were examined in this subset. The Yanomami prove to be quite variable, both within villages, with many mitochondrial haplotypes observed, and between villages (where haplotype frequencies and private polymorphisms vary from village to village). The patterns of variation is contrasted with the genealogical structures of the villages.

We also show preliminary data on Testes Specific Protein Y (TSPY) variation in the Yanomami. The TSPY gene has proven to be suitably polymorphic for studying within-population Y-chromosome variation. Previously only short tandem repeat polymorphisms were polymorphic enough for examining within population variation. Since STRs are often phylogenetically uninformative due to the high level of homoplasies, it is preferable to find a more discrete system with a lower forward/backward mutation rate, such as is described here). We present sequence variation from 780 nts of the first intron (and flanking exonic sequence) of the TSPY gene from a random sample of unrelated Yanomami.

This work was supported in part by the Department of Anthropology at the University of Michigan, and the Department of Human Genetics at the University of Pittsburgh.

Sexual dimorphism in the modern human femur: Application of linear and areal data. K.A. METZGER, C. LACOSTE, Department of Anthropology, University of California, Santa Cruz, Santa Cruz, CA 95064.

Previous studies of sexual determination and sexual dimorphism of the human femur have generally focused

solely upon linear data taken directly off of bone (Black, 1978; DiBennardo and Taylor, 1979; MacLaughlin and Bruce, 1983). In this study, linear data are combined with photographic areal measurements in order to provide a novel approach to the study of sexual dimorphism. In addition to expanding the range of possible measurements, such an approach allows for insight into dimorphism as it relates to muscle attachment sites on the bone.

A sample of 107 male and female femora was chosen from the Terry and W. Montague Cobb Collections in Washington, D.C. All individuals were designated as Caucasian and had completed femoral growth. Nine linear measurements as well as photographs of a standardized posterior aspect were taken and all photographs were digitized. In order to analyze areas of muscle attachment representing different muscle groups, standardized digital manipulations were made on the photographs and UTHSCSA ImageTool[®] was used to quantify areas.

Statistical testing conducted to determine differences in univariate measurements from the Terry and W. Montague Cobb Collections showed no significant differences with a confidence level of 99%. A similar analysis showed no significant differences among individuals in different age groups. Univariate and multivariate analysis of linear measurements indicated that femoral head diameter was the most accurate predictor of sex, producing correct discrimination 86.9% of the time. Additionally, femoral collo-diaphyseal angle was not statistically different between males and females ($\alpha=0.01$).

Analysis of areal measurements provided discrimination percentages of lesser utility. However, it also indicated that male and female femoral morphologies showed very few differences in ratios of areas of muscle attachment. Proportions of attachment sites in all measured areas were not statistically different, suggesting that any variance seen between males and females was confined solely to factors relating to size as opposed to ones of proportionality.

Enamel microdefects in a modern sample. L.M. MIFSUD and M.K. MARKS, Department of Anthropology, University of Tennessee, Knoxville, TN 37996

Developmental defects in tooth enamel (Wilson bands) have been routinely utilized by bioarchaeologists to ascertain prehistoric and historic fetal/maternal, infant and childhood morbidity. Wilson bands have been employed to develop inter-/intra-tooth chronology, underscore temporal relationships, and measured against other non-specific dental and skeletal stress indicators.

While hypoplasias are assignable within contemporary groups and their frequencies readily related to clinical events associated with sub-standard existence, microdefect patterns among such groups are unstudied and questions remain regarding chronology, sensitivity and distribution.

Teeth (N=237) were donated by African- and European-American patients from ten public health clinics and oral surgeons' offices in Tennessee and California. Age, sex, and socioeconomic background were provided focusing on mandibular canines and maxillary

central incisors. Like previous prehistoric research, these Wilson band frequencies indicate much greater sensitivity than enamel hypoplasias.

Similar to that research, first, second and third year frequencies were 1, 76 and 17%, respectively, which is common finding traditionally associated with weaning cycles. However, unlike previous findings, incisor and canine were equally susceptible to Wilson band development.

Finally, there is an obvious negative correlation between socioeconomic status and Wilson bands. Yet, regardless of socioeconomic, European-Americans displayed a significantly greater morbidity frequency compared to African-Americans (41%). This project not only confirms previous research on prehistoric samples but addresses demographic concerns involving differential susceptibility in living groups regardless of economic challenges that affect health.

Hand preferences for feeding in free-living simakobu monkeys (*Simias concolor*): The effects of posture and balance. C.T. MILLER, Anthropology, University of Colorado at Boulder, CO 80309. L.M. PACIULLI, D.P.A.S., S.U.N.Y. at Stony Brook, NY 11794.

Traditionally, handedness has been considered to be a unique human phenomenon. However, recent evidence has shown that behavioral lateralities exist in many other primates as well as some nonprimate animals. A number of factors have been hypothesized to affect the degree of handedness in nonhuman primates. One of these is the posture an animal assumes while feeding. Investigations into the positional behavior of free-living primates have demonstrated that animals frequently alter their posture while feeding. This study tested the hypothesis that an animal who switches its posture alters the hand used to perform a specific activity accordingly and at the same time must maintain a stable feeding stance. We recorded hand use while feeding in four free living simakobu monkeys (*Simias concolor*) at the Betumonga Research Station (North Pagai Island, Indonesia). The postures observed included sitting, vertical grasping, tripedal reaching, and extended reaching. A total of 457 instances of hand use while feeding was collected. The monkeys exhibited different degrees of individual level hand preference for feeding in the various postures. In addition to individuals demonstrating a preferred hand for feeding, the monkeys also exhibited a preference as to which hand supported the body during this activity. The degree of lateral bias for the support hand was significantly stronger when the animal braced itself on a large branch than a weaker, terminal branch. During instances when the non-feeding hand was free (i.e., not engaged in any activity), each individual exhibited a right hand preference for feeding. Thus, these data not only demonstrate individual hand preferences in a free-living primate species and its variability according to posture, but also a correlation between stability while feeding and the degree of hand preference.

This work was supported by a Fulbright Fellowship, the Dourri Couli Foundation, Primate Conservation Inc., Sigma Xi and the Undergraduate Research Opportunities Program of the University of Colorado at Boulder.

A hierarchical analysis of craniofacial variation in *Homo habilis* compared to a modern human analog. J.M.A. MILLER, G.H. ALBRECHT, University of Southern California, Los Angeles, CA 90033, and B.R. GELVIN, California State University, Northridge, CA 91330.

The *H. habilis* sample continues to be of interest with respect to the number of species it might represent. Miller, Albrecht, & Gelvin (1997) demonstrated that various intraspecific hypotheses (e.g., subspecific variation, sexual dimorphism) could not be rejected when the *H. habilis* sample (ER 1470, ER 1813, OH 24, and Stw 53) is compared to gorillas. However, such studies should be repeated using other analogs that may exhibit plausible patterns of variation for an early hominid species. We compare the degree and pattern of variation among *H. habilis* specimens with that of modern humans using a rigorously-controlled, hierarchical framework (Albrecht & Miller, 1993) that allows various intraspecific hypotheses to be examined.

We used W.V. Howells' sample of 2,416 adult modern humans representing 26 local populations from throughout the world. We used 24 craniometric variables that we could measure on casts of the four most complete crania of *H. habilis*. Principal components and canonical variates were used to interpret the craniometric differences among these fossils relative to the hierarchical framework of variability in modern humans.

The multivariate analyses of the hierarchical levels of variation in modern humans indicate that variability in *H. habilis*: (1) substantially exceeds that seen in same sex samples of single local populations, (2) marginally exceeds that of combined-sex samples of single local populations, (3) marginally exceeds the range of variation seen among all 1,156 females representing all 26 local populations combined, (4) is at the outer limits of variation seen among all 1,368 males representing all 26 local populations combined, (5) is consistent with overall variation among modern humans, which includes sexual and geographic variation. Since it is unlikely that geographically dispersed specimens such as Stw 53 (South Africa) and ER 1470, ER 1813, and OH 24 (East Africa) represent the same deme, a reasonable biological interpretation is that the fossils represent a combination of species level sexual dimorphism and interdemal (and/or subspecific) geographic variation. Moreover, this interpretation is strengthened since variation in the fossil sample is inflated by additional kinds of variation not seen in modern analogs, such as anagenetic change and distortion resulting from fossilization and reconstructive processes.

These findings are consistent with those of Miller, Albrecht, & Gelvin (1997) in that various intraspecific subhypotheses of the single species hypothesis cannot be rejected. The consistency of results when comparing *H. habilis* to analogs as different as modern humans and gorillas demonstrates the weakness of multiple species proposals. Furthermore, the present study highlights the effectiveness of hierarchical analysis in improving fossil interpretations in a biologically meaningful way.

Origin of Anthropoidea: dental evidence and the recognition of earliest anthropoids in the fossil record. E.R. MILLER, Duke University Primate Center, Durham, NC 27705, G.F. GUNNELL, Museum of Paleontology, University of Michigan, Ann Arbor, MI 48109, and E.L. SIMONS, Duke University Primate Center, Durham, NC 27705.

The best known undoubted anthropoid primates yet described are *Catopithecus browni*, *Serapia eocaena*, *Arsinoea kallimos*, and *Proteopithecus sylviae* from the late Eocene quarry L-41, Fayum Depression, Egypt. Two of these taxa, *C. browni* and *S. eocaena*, are the oldest known members of the Oligopithecinae and Parapithecidae,

respectively. *A. kallimos* and *P. sylviae* are archaic anthropoids of uncertain familial affiliation. Dental features of *C. browni*, *S. eocaena*, *A. kallimos*, and *P. sylviae* were compared with younger oligopithecines and parapithecids from the Fayum, in order to determine morphocline polarities of dental features among these African taxa. From this, an African basal anthropoid dental morphotype was constructed. Among the features of this hypothetical morphotype are: dental formula of 2.1.3.3; incisors vertically implanted and somewhat spatulate; anterior lower premolar (P/2) larger than P/3, both lacking paraconids; anterior upper premolar (P2/) smaller than P3/, both lacking paracones; P/3 oriented anteroposteriorly (not oblique oriented in jaw); lower molars with small paraconids; upper molars with small, cingular hypocones; all cheek teeth non-bunodont; canines projecting and sexually dimorphic.

Comparisons were then made between this anthropoid ancestral morphotype and other proposed anthropoid primates from Africa, Arabia and southeastern Asia (*Algeripithecus*, *Tabelia*, *Biretia*, *Djebelemur*, *Eosimias*, *Siamopithecus*, *Amphipithecus*, and *Pondaungia*). Results of these comparisons suggest the following: 1) *Eosimias* can be viewed best as a primate of uncertain affinities, perhaps most closely related to tarsoids; 2) *Djebelemur* is a cercamoniine adapiform as it was originally described to be; 3) The remaining taxa may represent early anthropoids but as presently known, none appear to have been likely predecessors of any of the L-41 anthropoids.

Facial flexion and craniometric variation in the platyrrhine genus ALOUATTA.

J.R. MILLER and D.R. BEGUN, Department of Anthropology, University of Toronto, Toronto, Canada M5S 3G3

The platyrrhine genus *Alouatta* is one of the few primate taxa that demonstrate facial airorhynch. The condition is traditionally identified among a suite of cranial features thought influenced by vocal tract adaptations in howling monkeys. This study presents new data regarding the variability of facial flexion within the genus, and relates it to cranial measurements taken from a large sample representing both adult males and females of the 6 commonly recognized species.

Lateral radiographs of *A. belzebul*, *caraya*, *fusca*, *palliata*, *pigra* and *seniculus* were used to determine the concordance of facial flexion to taxonomy and hyoid morphotype. Three angles representing the intersects of the basion, sphenoidal point, and prosthion were obtained and compared with univariate craniometric data. The results indicate a bimodal distribution among the 2 species of the *palliata* group for both cranial base and sphe-no-maxillary angles, a phenomenon attributable to interspecific variation. *A. pigra* is most similar in all angles to non-*palliata* species, and significantly different from *A. palliata* in its cranial base angle ($H=12.40$ $p=.030$, Dunn's test at alpha 0.05). Flexure from the sphenoidal plane is also bimodal within the non-*palliata*

group, not fully attributable to sexual differences. The data indicate a clinal distribution of facial kyphosis, but one that does not reflect a priori assumptions regarding hyoid specialization in the genus. It is suggested that the similarity between *A. pigra* and species with a morphotypically large bashyoid indicates that expansion of the hyolaryngeal apparatus in howling monkeys is facilitated by the development of an ariorynch condition. This premise is substantiated by craniometric data where *A. pigra* is similar to non-*palliated* species and significantly different from *A. palliated* in key regions such as the cranial base, in particular the length of the posterior pharynx.

Recording visual information with digital images. F. MINTZER, J. CHRISTENSEN, F. GIORDANO, IBM Watson Research Center, Yorktown Heights, NY 10548.

The photograph has long history of being used to record visual information for anthropological study and for many other scholarly pursuits. Indeed, for many years, photographic materials have been nearly the only media used for recording visual information. Now, however, there is an alternative for recording such information - the digital image, and digital images possess some advantages over photographs. In this talk, we will discuss desired properties of the media used to store visual information. These properties include longevity, portability, cost and convenience of capture, ease of analysis, storage costs, storage size, accurate detail, accurate color, and resistance to tampering. We will also compare photography and digital images with respect to these properties.

The distribution of an insertion/deletion polymorphism in the Collagen 1 gene (COL1A2) and a VNTR in the Dopamine transporter gene (DAT1) in human populations. R.J. MITCHELL, S. HOWLETT, L. WILCOX, La Trobe University, Melbourne, Australia, J. McCOMB, M.H. CRAWFORD, University of Kansas, Lawrence, KS, and M.S. SCHANFIELD, AGTC, Denver, Co.

This study reports on the frequencies of an insertion/deletion polymorphism within collagen 1 gene (COL1A2) and alleles at a VNTR in the dopamine transporter gene (DAT1) gene. COL1A2 has 2 alleles representing either the presence (641 bp) or absence (603 bp) of a 38 bp sequence, whereas a total of 8 alleles has been found at the DAT locus, each reflecting the number of copies of the 40 bp core sequence in each allele. Both these polymorphisms have been examined as markers for the association of the respective genes with disease states: osteogenesis imperfecta in the case of COL1A2 and major neurological and psychiatric disorders, including schizophrenia, in the case of DAT1. These two markers have also been used to assess levels of diversity among major ethnic groups. However, there has been little investigation of use of these 2 markers in studies of variation at the population level.

We scored these polymorphisms in a selection of populations including five indigenous groups from Siberia (Ket, Evenki, Altai, Selkup, and Chuvash), native Americans (USA) and north Africans. Whereas most Africans are monomorphic at COL1A2 (641 bp allele) all our populations (including north Africans) showed polymorphism. The frequency of the 603 bp allele among the Siberians ranged from 0.18 in the Altai to 0.34 in Evenki and the native American sample exhibited a frequency of 24%. The north Africans resembled south Europeans in their frequencies.

The DAT1 polymorphism exhibits greater variation among Siberian groups, and is generally much more informative on population affinities. The most common allele, 10, ranges in frequency from 71% in Selkups to 94% in Kets. The 13 allele, previously only seen in Mongolians, is found in Altai, but not in other groups. Allele 11 had a particularly high incidence in Evenki (12%) which is by far the highest ever reported (usually <2%). Overall, Siberian groups display frequencies of allele 10 intermediate between those in Europeans (70%) and Asians (90%+). Native Americans were most similar to Siberian groups.

Our findings suggest that these 2 polymorphisms, but particularly DAT1, are informative on admixture and affinities at the population level.

What were they doing? Reconstructing Stone-Age life at Ajvide, a burial ground on the island of Gotland in the Baltic sea. P. MOLNAR, Archaeosteological Research Laboratory, Stockholm University, Sweden

Using an osteobiographical methodology, including the analysis of a number of distinctive skeletal features, and emphasizing on musculoskeletal stressmarkers that appear on the human remains from Ajvide, a description of the lifeways of the Swedish Stone-Age population will be attempted. The analyses are presently in the initial stages, and results will be presented in a doctorate thesis at the Department of Archaeology, Stockholm University.

The excavations of the Stone-Age (ca 2750 B.C.) burial ground of Ajvide on Gotland, Sweden, has resulted in 56 graves with the well-preserved skeletons of 50 individuals. Men, women and children have been buried in single, double and triple graves. The Ajvide people were seal-hunters, pig-keepers, fishers and gatherers.

One skeletal feature of special interest in the Ajvide material is the presence of a pit at the place of attachment of the musculus gastrocnemius medialis on the femur. It is about 1 cm in diameter and appears on either or both sides, but only in male individuals. This feature has been noted on several other male skeletons from the same period on Gotland, but not from any other materials from other parts of Sweden. Attempts have been made trying to explain this feature as the result of paddling a canoe, or throwing a harpoon. One aim of this study is to find the cause of this peculiarity.

Another skeletal trait in the Ajvide material is an extremely oblique and excessive tooth wear on the lower molars, which could be explained as results of using these teeth as a third hand. This specific wear has not been noted on any other skeletal populations in Sweden.

Data indicate that comparisons with the gotlandic and other contemporary populations in Sweden show the divergence of skeletal features depending of peoples lifestyles.

Differences in subsistence can lead to diverging working habits and subsequently result in variations in the skeleton.

Because of its excellent state of preservation and size, the Ajvide material provides an extraordinary opportunity to make extensive and detailed anthropological research. We will have the possibility to connect one particular skeletal feature to an exact movement and a certain activity that took place 5000 years ago.

Perinatal brain growth in craniosynostotic rabbits. MP MOONEY, GM COOPER, AM BURROWS, TD SMITH, J DECHANT, HW LOSKEN, JL MARSH, MI SIEGEL, University of Pittsburgh, Pittsburgh PA, and Washington University, St. Louis MO.

It has been suggested that abnormal prenatal brain growth or size may be an etiogenic factor of premature calvarial suture synostosis due, in part, to a lack of tension at the sutural margins. The present study was designed to test this hypothesis in a rabbit model of human, nonsyndromic coronal suture synostosis. Thirty-four brains (68 hemispheres) were harvested from 22 normal control rabbit perinates and 12 rabbit perinates with unilateral or bilateral coronal suture synostosis ranging in age from 25 to 32 days postconception (synostosis occurs at approximately 23 days in this model). The calvariae were removed, the brains were fixed in 10% paraformaldehyde, and *in situ* bilateral measurements of neurocortex length, width, width-to-length index, and head length were obtained using a Wild microscope with a camera lucida attachment and caliper. Linear regression analysis was used to compare perinatal brain growth rates between the two groups. Results revealed that neurocortex and head length regression line slopes had similar start points (24 day age intercepts) with significantly ($p < 0.05$) diverging slopes over time. Normal rabbits increased more rapidly than synostosed rabbits. No significant ($p > 0.05$) differences were noted in regression line slopes between groups for neurocortex width or width-to-length indices in the perinatal ages studied. Results suggest that reductions in brain length are probably a compensatory, postsynostotic event and not an etiogenic factor of craniosynostosis in this rabbit model of familial, nonsyndromic coronal suture synostosis.

Supported in part by grants from NIDR (DE010830), Children's Hospital of Pittsburgh, Plastic Surgery Educational Foundation (PSEF), and the Central Research Development Fund (CRDF), University of Pittsburgh.

Use of craniofacial anthropometry to determine pattern of inheritance in Beckwith-Wiedemann syndrome. E. S. MOORE, Indiana University, Bloomington, IN 47405 and R. E. WARD, Indiana University at Indianapolis, Indianapolis, IN 46202.

Beckwith-Wiedemann syndrome (BWS) is a rare overgrowth disorder that results in variable clinical and

phenotypic expression. BWS may be a multigenic disease and research has focused on several genes (IGF-2, H19, p57, KVLQT1) located on 11p15. In some individuals diagnosed with BWS, 11p15 can have chromosomal alterations, abnormal imprinting, and uniparental disomy.

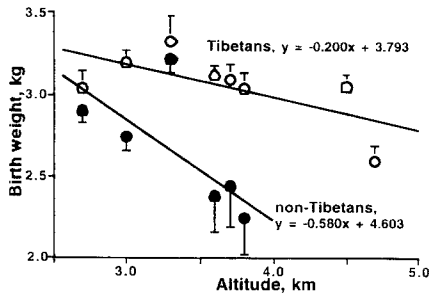
Currently, some researchers suggest that the variability in phenotype may be due to the diminution of clinical signs with age and that a distinct pattern profile for BWS exists within age groups. However, our research suggests that variability in the craniofacial expression of BWS may be associated with the nature of the genetic defect and its pattern of inheritance.

Cluster analysis was performed on 20 craniofacial anthropometric measurements from 19 children diagnosed with BWS. Individuals with a positive family history of BWS clustered separate from suspected sporadic cases. Pattern profiles of these clusters suggest that there may be significant differences in the expression of certain craniofacial traits depending on the origin of the genetic defect. Furthermore, pattern profiles may also indicate that in cases where inheritance is passed through the maternal line differs phenotypically from paternally derived and sporadic cases. Maternally inherited cases have a pattern profile that is "classic" BWS. These individuals have large faces with large mouths, wide-spaced eyes, wide noses and small ears. Suspected sporadic cases have a pattern similar to maternally derived cases, but are less "classic" in that craniofacial traits are not as large and they are brachycephalic with short, flat faces, small palpebral fissures, and wide short noses and ears. The cluster that represents paternally derived cases has a pattern profile distinct from the other two clusters. For these individuals overgrowth tends to occur in length so that they are dolichocephalic with long, flat faces, and big ears.

The distinct pattern profiles of these clusters may give some insight into the complicated genetic mechanism(s) behind this condition by associating a distinct phenotype with the origin of the genetic defect and a specific pattern of inheritance.

Less altitude-associated birth weight decline in Tibetans than non-Tibetans in Tibet. LG MOORE, TS DROMA, S ZAMUDIO. Univ of Colorado at Denver and Health Sciences Ctr, Denver, CO 80262 and Tibet Inst Medical Sci, Lhasa, PRC 850000.

Tibetan birth weights at 3658 m are similar to low-altitude Tibetan values and greater than their altitude counterparts elsewhere in the world (Moore 1990, Zamudio 1993). To establish whether birth weights are preserved across a broad range of altitudes, we compared all infants born to Tibetans and non-Tibetans (chiefly Han) in 4 district hospitals and 4 local clinics during a one-year period in Tibet. A total of 343 Tibetan births occurred at 2700-4700 m and 82 non-Tibetan births at 2700-3800 m. No non-Tibetans were born above 3800 m. All Tibetan parents had been born at their altitude of residence whereas most non-Tibetans had been born near sea level. The two groups were similar in maternal age (26 ± 1 vs 25 ± 0 yr), paternal age (29 ± 1 vs 28 ± 1 yr), parity (1.4 ± 0.1 vs 1.5 ± 0.1 previous births) and gravidity (1.6 ± 0.1 vs 1.6 ± 0.1 previous pregnancies). Weights were obtained at delivery using scales provided and calibrated by the investigators. Gestational ages were similar between groups: 63% of Tibetans were normal, 5% early, 2% late whereas 60% of non-Tibetans were normal and 10% were early. Gestational age was missing for 30% of each group.



Altitude reduced birth weight in both groups. Tibetans weighed more than non-Tibetans across all altitudes and at 3000, 3600 and 3800 m ($p < 0.05$). The linear regression slope was steeper in non-Tibetans than Tibetans (figure) and there was significant interaction between ethnicity and altitude (2-way ANOVA), indicating a lesser effect of altitude in Tibetans than non-Tibetans. The present results support previous findings and indicate that Tibetans are protected from altitude-associated IUGR relative to other high-altitude groups (NSF BNS 8919645, NIH 14985).

Patterns of variation in the platyrrhine cranio-orbital region: Implications for reconstructing the platyrrhine morphotype. W.D. MOORE, Department of Anthropology, Southern Illinois University, Carbondale, IL 62901

The importance of the cranio-orbital region in reconstructing anthropoid origins is well established. This morphological complex has also been shown to be key in understanding the strepsirhine-haplorhine dichotomy. This study examines the qualitative-quantitative patterns of variation as reflected in the extant platyrrhine cranio-orbital region and whether these patterns are useful in discerning subfamilial groupings or for reconstructing the ancestral morphotypic complex.

A total of 200 specimens representing 44 species of extant platyrrhines are included. In addition, several strepsirhine and catarrhine specimens are analyzed for comparative purposes. Morphological variation is then compared to the relative size of the orbits in order to test for congruence between the latter variables. That is, is relative orbit size reflected in the morphology of the cranio-orbita? Relative orbit size is established by calculating least squares regression of orbit diameter (superior-inferior) against greatest skull length.

Results indicate that there are limits to the congruence between cranio-orbital morphology and relative orbit size. However, there are many morphological similarities shared between the cebine grouping (*Callicebus*, *Aotus*, *Cebus*, *Saimiri*) and the callitrichine grouping (*Leontopithecus*, *Saguinus*, *Callithrix*, *Cebuella*, *Callimico*). *Callicebus*, *Cebus*, and *Saimiri* cluster closely with the callitrichines to the exclusion of *Cebuella*. This group probably reflects the ancestral morph. The atelines (*Ateles*, *Brachyteles*,

Alouatta, *Lagothrix*) form a distinctly derived group. The pitheciines overlap significantly with the ateline group and the *Callicebus-Cebus-Saimiri*-callitrichine group. *Aotus* represents an obvious outlier due to its functional adaptations to nocturnality. These results will be compared to other qualitative-quantitative studies of the platyrrhine cranial form (cf. Hartwig, 1993).

A test of the two species hypothesis in the Levant using a cluster analysis of mandibular measurements. W. L. MOORE, The University of Tennessee, Knoxville, TN 37996.

Recently, craniometric and morphological studies have attempted to determine whether the Late Pleistocene Levant was inhabited by one highly variable or two distinct hominid species. However, the mandible has rarely been employed in this endeavor, which is surprising as it is the skeletal element most often represented in the fossil record and is responsive to both behavioral and genetic changes.

This study uses metric measurements of male mandibles in both non-hierarchical cluster and principal coordinates analyses to test the two species hypothesis. If this hypothesis is correct, then it is expected that the Levantine hominids generally classified as "Neandertals" (Amud 1, Tabun C, Kebara 2) would distinctly cluster with the European Neandertal sample ($N=8$) while the Levantine "modern humans" (Qafzeh 9, Skhul 4 and 5) would cluster with a modern human sample (represented by 24 Native American mandibles).

Missing data is estimated using a finite mixture missing data estimator, which also performs the non-hierarchical cluster analysis. This analysis reveals two significantly distinct clusters, one predominately Neandertal and the other modern human. As expected, in the two species model, Amud 1, Tabun C and Kebara 2 cluster with the European Neandertals and Skhul 5 clusters with the modern human sample. However, Skhul 4 and Qafzeh 9 cluster with the Neandertals instead of with the modern human sample.

A correlation of the original variables with the principal coordinates reveal how the two clusters are discriminated primarily by the first principal coordinate. Mandibular corpus breadth at P_3 and M_1 and the bucco-lingual width of P_4 and M_1 load heavily and with opposite signs on this coordinate. The modern human cluster is distinguished by a narrow mandibular corpus, and relatively wider bucco-lingual dimensions. The Neandertal cluster is characterized by a wide corpus and bucco-lingually narrower P_4 s and M_1 s. Skhul 4 follows this trend, sorting most closely with the European Neandertal from Regourdou.

This study suggests that the Levant may have been populated by one highly variable hominid species, much as McCown and Keith (1939) originally speculated.

Nuclear DNA single nucleotide polymorphisms (SNPs): how much can extant variation tell us about human origins? J. L. MOUNTAIN, Department of Integrative Biology, University of California, Berkeley 94720-3140.

Each new set of genetic markers (blood group, HLA, mitochondrial DNA, microsatellite, Y chromosome) has

provided additional detail regarding human genetic diversity. Through analysis of this diversity researchers have gained insight into the evolution of our species. Now the search for large numbers of nuclear DNA single nucleotide polymorphisms (SNPs) is underway. Multiple methods for ascertaining and screening SNPs are already available to medical and anthropological geneticists. Assuming that thousands of such polymorphisms are found, and are readily typed in human populations, what can we expect to learn from such data? Previous work on restriction fragment length polymorphisms (RFLPs) typed using Southern blotting enables us to make some predictions.

From data for up to 100 RFLPs the extent of genetic diversity within and between human populations has been estimated. Both population and "individual" trees have been inferred. For several questions, however, the number of independent RFLPs has been too few to draw strong conclusions. With at least an order of magnitude more SNPs we can expect to learn more about relative population sizes and relationships among ancestral populations. A larger number of markers is particularly critical for the inference of admixture, of gene flow, of recent immigration, of trees of individuals, and of trees of closely related populations. Furthermore, results based on SNPs will be more reliable than those drawn from RFLP data if these SNPs are free of the ascertainment bias that has accompanied RFLP studies of the past.

Supported by NIH grant GM20428 to Montgomery Slatkin.

Enamel microwear in a southeastern Mississippian sample. M.G. MUENDEL and M.K. MARKS, Department of Anthropology, University of Tennessee, Knoxville, TN 37996

Qualitative SEM analysis of enamel microwear patterns has been used successfully to interpret diet in prehistoric humans, hominids, primates, and non-primate mammals. Quantitative methods in dental microwear research unfortunately are in their infancy because of a lack of standardization. This paper exhibits the application of *Microware 3.0* (Ungar, 1997 - a metric and statistical software program) to a large sample (N=104) of permanent second mandibular molars from a prehistoric Late Mississippian site (Averbuch - AD 1150 - 1350) from central Tennessee.

Mesiolingual cusps were examined at 40, 200 and 500 magnification measuring features at 500x with results generated using *Microware 3.0*. After data transformation, ANOVA and MANOVA procedures were run using SPSS.

These results revealed no wear pattern relationship by age or sex within and among three distinct cemetery components. It is not surprising that inter-cemetery differences were undiscernable given the short temporal nature of the site. It is perplexing that intra-cemetery differences in age and sex were not found given social complexity and rank during the Mississippian. Qualifiable

results characterize enamel with numerous pits, troughs, scratches and varied striation morphology consistent with the archaeological, faunal and botanical evidence.

These analyses indicate that Mississippian diet during the Middle Cumberland phase in the Nashville Basin was more varied and complex than expected with no clear suite of microscopic features predominant or indicative of general or specific dietary reliance.

Bone remodeling in a Medieval Nubian population: A comparison of the rib and femur. D.M. MULHERN, Colorado College, Colorado Springs, CO 80903.

The purpose of this project is to assess differences in bone remodeling rates in the femur and rib in a Medieval Nubian population. Bone remodeling is a cyclic process of resorption and formation which occurs throughout an individual's life. Because bone is a dynamic tissue, bone remodeling responds to nutritional and mechanical demands. The rib and femur have different functional requirements, so bone remodeling within the same individual for these two bones may reflect differences in function.

The skeletal population chosen for this study is from Kulubnarti, in Sudanese Nubia dating from 550-1450 A.D. These skeletal remains are naturally mummified and are therefore excellently preserved. The study sample consists of 80 rib and 43 femoral thin sections from individuals ranging 15 to 50+ years at age of death. Thirty-five individuals are represented in both samples.

Histomorphometric analysis was conducted using an image analysis system. Variables including mean osteonal cross sectional area, mean activation frequency and bone formation rate were calculated.

Results indicate that females have larger mean osteonal cross sectional areas (0.038 mm^2) compared to males (0.034 mm^2 ; $p < 0.05$), but males have more intact osteons ($9.7/\text{mm}^2$) compared to females ($6.7/\text{mm}^2$; $p < 0.05$) in the femur. No differences between the sexes were observed for the rib.

Differences between the sexes observed in the femur (a weight-bearing bone) are likely due to differences in mechanical demands, particularly since these differences are not observed for the rib (a non-weight-bearing bone). The involvement of males and females in different kinds of subsistence tasks may have contributed to differences in bone remodeling.

This research was supported by a Dean's Small Grant and a Dissertation Assistance Fund Grant, both awarded by the University of Colorado.

A test of the accuracy of techniques used to determine sex in the mandible. E.K. MULLER, Department of Geography and Anthropology, Louisiana State University, Baton Rouge LA 70803.

The mandible is used for sex assignment in paleodemographic and forensic studies as the

mandible is durable and often remains intact following death. Sexual dimorphism exists in both the morphology and osteometry of the mandible. This study tests the accuracy of techniques used in sex determination.

For this study 100 mandibles from the Hamann-Todd collection at the Cleveland Museum of Natural History were assessed. The specimens ranged in age from 20 to 40 years and were equally divided between the sexes. The mandibles were seriated on the basis of the single morphological characters: gonial flaring, chin shape, and ramal flexure.

The results show that gonial flaring exhibits the highest accuracy for sex assignment (76%). The accuracies for chin shape and ramal flexure are lower and approximately equal with each other. The rank order correlation between gonial flaring and ramal flexure is significant ($r_s = .32, p = .001$), whereas the correlations of chin shape with gonial flaring and ramal flexure are low and non-significant.

The results of this study are discussed relative to paleodemographic and forensic studies.

This research was supported by a grant from the Robert C. West fund, Louisiana State University.

Unique Neandertal noses: Variation in the internal morphology of the nose. M.S. MURPHY, University of Pennsylvania. J. Monge, University of Pennsylvania and Bryn Mawr College, A. Mann, University of Pennsylvania

Recently the internal morphology of the nose, specifically the orientation of the lateral margin of the nasal aperture, has been described in a small Neandertal sample (Schwartz and Tattersall 1996). This morphology has been interpreted as an autapomorphy and has been used to distinguish Neandertals from *Homo sapiens*.

In this study, 200 modern specimens from geographically diverse populations, including European, African, Middle Eastern, Greenlander, and native Alaskan, have been studied to document the distribution of the morphology of the nasal aperture in a broad modern sample. A variety of digital imaging techniques was employed in order to quantify and compare the complex morphology of the nasal aperture. A subsample of ten specimens was scanned using computed tomography techniques to determine the relationship between the maxillary sinuses and the nasal aperture.

The results of this study indicate that the distribution of the morphology of the lateral margin of the nasal aperture is significant in some modern human groups. Also, this pattern may be a physiological adaptation

related to the northern climates of some of these populations. Moreover, the results of the CT scans show a relationship between the maxillary sinus and the internal nasal morphology. This work provides a broader modern human database from which Neandertal morphology can be understood.

The Osteological Paradox: Bioarcheological Evidence from Arkansas. K.A. MURRAY, Department of Anthropology, University of Arkansas, Fayetteville, AR 72703

It is often assumed that a direct relationship exists between the health of a population and the incidence of skeletal pathological lesions and stress indicators such as dental hypoplasias. Wood et al. (1992 *Current Anthropology*;33(4):343-370) have suggested that the occurrence of low skeletal and dental lesions may reflect either an advantaged population where stress and pathology are not a factor, or a disadvantaged population, where individuals succumb to the stress episode.

This study employs the bioarcheological analysis of 44 burials from the Parkin site, where ongoing archeological investigations have recovered material from two major loci. These loci have dates differing by at least one hundred years, with the later corresponding with the explorations of Hernando de Soto (mid 1500's - 1600).

The skeletal data from each loci are compared, revealing evidence of a lower level of stress in the earlier period. Comparative analysis of paleodemographic data, dietary reconstruction, non-specific stress indicators, and skeletal lesions provide evidence that European disease began to decimate the populous area of the Lower Mississippi Valley soon after the explorations of Hernando de Soto. For example, paleodemographic data indicates an overall younger mean age at death and lower fertility rate during the later time period. The dietary data and hypoplasia data from both time periods suggest similar food producing and food gathering techniques. However, a drastic reduction in the rate of infectious skeletal lesions and the incidence of hypoplasias during the later time period reflects mortality as opposed to morbidity.

Age, activity, and musculoskeletal stress markers.

B.L.B. NAGY, Department of Anthropology, Arizona State University, Tempe, Arizona 85287-2402.

This research addresses the extent to which behavior and biological aging processes affect the expression of

musculoskeletal stress markers (MSM), morphological changes on bone at the attachment sites of muscles and ligaments. 67 MSM were recorded from over 500 individuals representing two prehistoric North American skeletal populations. One group were archaic-period hunter-gatherers, the other late pre-contact sedentary horticulturalists.

ANOVA analyses revealed significant differences in MSM scores between age groups. However, the differences in mean scores among the age groups vary by MSM site. This variation does not show clear patterning within or between either populations or sexes.

While the relationships between age, sex, and MSM are clearly complex, these results support the hypothesis that MSM expression is largely determined by behavior rather than innate biological factors. The results of this research suggest that any age effect in MSM expression is likely the cumulative result of long-term activity patterns.

Craniofacial form and regional population affinities: A comparative approach to Paleo-Indian origins. R. NELSON. Museum of Anthropology, University of Michigan.

Who were the first Americans? Where did they come from? Do they have any living descendants, or were they replaced by subsequent groups of people? These questions are being approached by biological anthropologists from a morphological perspective (Neves and Pucciarelli, 1991; Steele and Powell, 1992; Lahr, 1995; Jantz and Owsley, n.d.), with results suggesting closest Paleoindian ties with comparative samples ranging from Australia to Europe.

This paper will present an alternative assessment of Paleo-Indian, Archaic, and later horizon crania in the context of a database being developed specifically to examine population relations in the prehistory of the New World. The University of Michigan Museum of Anthropology database is comprised of a battery of 24 craniofacial dimensions for 7200+ individuals representing all the major cultural and geographic regions of the world. The New World component of 2000+ represents a broad geographic as well as temporal sampling of prehistoric populations, and is ideal for comparisons of this nature. Paleo-Indian samples examined include the Spirit Cave and Wizard's Beach burials from Nevada, the Buhl, Idaho burial, and the Brown's Valley and Minnesota Woman burials from Minnesota.

Examination of patterns of morphological variation in craniofacial form among prehistoric New World populations has produced regional cluster patterns (Nelson, n.d.). Many of these are consistent with the regional type descriptions published by Neumann (1952), but in other cases the parallels are not so clear.

The results of this study, results which are broadly compatible with recent mtDNA and Y-Chromosome work (Hammer and Zegura, 1996), indicate clear ties to later (Archaic) Amerind groups. This work is preliminary, but presents the possibility that Paleo-Indians may not be as different from subsequent Amerind groups as suggested (Neves and Pucciarelli, 1991; Steele and Powell, 1992). It is crucial to understand the physical and temporal continuities of which they are part, and not to characterize later Amerinds as an homogenous whole on the basis of a few samples.

Lapa Vermelha IV Hominid 1: Morphological affinities of the earliest known American. W.A. NEVES, Instituto de Biociencias, Universidade de Sao Paulo, C.P. 11461, 05422-970 Sao Paulo, Brazil, A. PROUS, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil, J.F. POWELL and E.G. OZOLINS, Department of Anthropology, University of New Mexico, Albuquerque, NM 87131.

Several studies concerning the extra-continental morphological affinities of paleo-indian skeletons, carried out independently in South and North America, have indicated that the Americas were first occupied by non-mongoloids. The first South Americans show a clear resemblance to South Pacific and African populations, while the first North Americans seem to be in an unresolved morphological position between South Pacific and Europeans. In none of these analyses do the first Americans show any resemblance to either northeast Asians or modern native Americans. So far, these studies have included affirmed and putative early skeletons thought to date between 8 and 10,000 years BP. In this work the extra-continental morphological affinities of a paleo-indian skeleton well dated between 11 and 12,000 years BP (Lapa Vermelha IV Hominid 1) is investigated, using as comparative samples Howells (1989) world-wide modern series and Habgood (1989) Old World Late Pleistocene fossil hominids.

The comparison between Lapa Vermelha Hominid 1 and Howells series was based on canonical variates analysis, including 45 size-corrected craniometric variables, while the comparison with fossil hominids was based on principal components analysis including 16 size-corrected variables. In the first case, Lapa Vermelha Hominid 1 exhibited an undisputed morphological affinity first with Africans and second with South Pacific populations. In the second comparison, the first known American skeleton had its closest similarities to early Australians, Zhoukoudien Upper Cave 103, and Taforalt 18. The results obtained clearly confirm the idea that the Americas were first colonized by a generalized *Homo sapiens sapiens* population which inhabited east Asia in the Late Pleistocene, before the definition of classic mongoloid morphology.

Financed by FAPESP, CNPq and UNM.

Comparative dimensions of hands in Hylobatidae and Pongidae: a preliminary report.
K.A. NICHOLS, University of Colorado. Boulder, CO 80309

The hands of siamangs and gibbons (Hylobatidae) are utilized in locomotion (brachiation) in a manner distinct from the locomotion employed by the large-bodied great apes (Pongidae). Because of this distinctive locomotor pattern one would expect that siamangs and gibbons would differ from great apes in hand and forelimb musculature. However, quantitative information on ape soft-tissue anatomy in general is rare and rarer still in siamangs and gibbons. This study

presents quantitative data from both hylobatids and pongids on (1) the relative proportions of hand and foot tissue types (muscle, bone, skin and fat) and (2) distribution of extrinsic and intrinsic forearm and hand musculature.

This study is based on (1) a sample of 5 captive adult individuals representing three lesser ape taxa (*Hylobates syndactylus*, *H. pileatus*, *H. lar*) and (2) a sample of 15 captive adult individuals representing four great ape taxa (*Pongo pygmaeus*, *Gorilla gorilla*, *Pan troglodytes*, *P. paniscus*). The anatomical method utilized entails dissection of whole animals with weights taken of hands and feet, individual tissue types, and individual forearm and hand muscles (after Grand, 1977). Mean averages and proportions were calculated for segment components, tissue composition, and muscle groups.

As expected, a distinct pattern in tissue composition of hand and foot segments characterizes the lesser apes and great apes. For example, siamang and gibbon hands show a pattern wherein more muscle (36%) is present in hands than in feet (26%). In contrast, the muscle mass of great ape hands is either equivalent or less than in feet (*Gorilla*, hands 23%, feet 21%; *Pan*, hands 29%, feet 30%; *Pongo*, hands 25%, feet 34%). In the distribution of intrinsic hand musculature, however, there is overlap between the hylobatids and pongids in thumb and digit proportions. For example, the siamangs and gibbons have relatively heavy thumbs (30%) and light digits (17%), as do *Pongo* and *Pan*. The greatest contrast to this pattern is found in *Gorilla* with nearly equivalent thumb (19%) and digit proportions (22%).

These results indicate a pattern in hylobatid hand and foot segment tissue composition distinct from the pongid pattern, as well as overlap in some comparative hand dimensions. These data add to our understanding of the soft-tissue anatomy of ape hand morphology.

Humans as a case study for the evidence of evolution.

M. K. NICKELS, Illinois State University, Normal, IL 61790-4640.

Physical anthropologists are in an enviable and almost unique position to educate students about the theory and evidence for evolution. Our focus on the human species enables us to take advantage, not only of the innate interest students have in learning more about themselves, but also of the unequaled amount of evidence available to support the case for human evolution. There is simply no other species for which so much anatomical/skeletal, biochemical, embryological, genetic, biogeographical, paleontological, and--uniquely for humans--behavioral (in the form of archaeological) evidence is available to make the case for evolution. Just as important pedagogically, however, is the advantage of using humans as a central focus or case study in presenting the evidence for evolution because it enables us to deal directly and convincingly with the single most problematical species for most people to accept as having evolved: our own. After focusing on humans and using our own species to learn about the strength of the evidence for evolution, students

are much less likely to object to the idea of evolution being applied to the rest of the biological realm.

This presentation will focus on the advantages of using humans as a central case study for evolution, pedagogical strategies that are effective in doing so, and will outline the cumulative evidence for humans having evolved.

Vertebral pathology from a Byzantine Judean monastery. SE NIEBUHR, *Department of Anthropology, Indiana University, Bloomington, IN 47405*, and SG SHERIDAN, *Department of Anthropology, University of Notre Dame, Notre Dame, IN 46556*

This project is part of a larger investigation into life in a large 5th century monastic community from Jerusalem. Due to the ossuary burial-style, the bones were separated by type. The vertebral elements are the focus of this poster.

Of more than 15,000 skeletal elements removed from a single repository in the crypt complex, 1,275 vertebrae were examined. 169 of these belonged to juvenile individuals. There were no pathologies in the subadult vertebrae, and they were thus removed from any further analysis.

The 1,106 adult vertebral elements include an assortment from all five regions of the spinal column, cervical to coccygeal. The minimum number of individuals (MNI) ranged between 35 and 56, depending on the region of the vertebral column looked at. The most reliable count is from the axis (C2), with a MNI of 51.

Analysis of these vertebrae indicates a generally healthy life for most individuals, with normal age-related degenerative changes. Striking exceptions include five sets of fused vertebrae from the cervical and thoracic regions, spina bifida occulta, and cut marks on cervical vertebrae two and three of a single individual.

The application of photogrammetry to small fossil specimens. W. A. NIEWOEHNER, *University of New Mexico, Department of Anthropology, Albuquerque, NM 87131*.

Traditional osteometric measurements are often employed when collecting data on fossil specimens. These methods are preferred because the equipment, usually calipers, is easily transported and inexpensive and the data are usable for both univariate and multivariate statistical analyses. Unfortunately, linear and angular measurements

alone inadequately capture the geometry of complex biological shapes.

Photogrammetry, the method by which 3-D data points are derived from digitized photographs, can be used when mathematical reconstructions of complex shapes, such as joint surfaces, are desired. This requires two fixed-position metric cameras, complex control targets, and an analytical plotter for calculating the 3-D points. The disadvantages of standard setups include their expense, non-portability, and (often) the requirement that the digitizing points be drawn on the specimens. These limitations cannot be overcome with fossil specimens since the equipment must be brought to the specimens, and the specimens left unmarked and undamaged.

A portable, inexpensive photogrammetry setup is used by this author to collect 3-D data on fossil hominid hand bone joint surfaces. The specimen is mounted on a 16 x 10 x 30mm cube marked with digitizing control points. A slide projector is used to project a 10x10 grid onto the joint surface, providing digitizing targets. Photographs from two or more non-standardized angles are taken with a single, calibrated, 35mm camera with a 90mm (1:1) macro lens. The negatives are scanned and imported into a commercial photogrammetry software package (Photomodeler, EOS Systems). The gridline intersections and control points are digitized on a PC. From these points, the software determines the camera orientations and calculates a matrix of scaled 3-D points accurate to 0.1mm. These data can be used for mathematical surface reconstructions or the morphometric analysis of landmarks.

This research is supported by the L.S.B. Leakey Foundation and the N.S.F. (SBR-9712593).

Anthropometric characteristics of infants with cranial deformities. M.J. NORTON, Department of Anthropology, CSU at Long Beach, CA 90840.

The craniofacial skeleton is composed of several dynamic functional units. These include the vault, basicranium, and the face. Growth and development of the infant craniofacial skeletal system responds differentially to external mechanical pressures. Most infants experience some degree of skull molding during the birth process, but the skull usually rebounds to a symmetrical, round shape shortly after birth. The most common infant cranial deformities are positional plagiocephaly and brachycephaly; flattening deformities of the occipito-parietal regions of the skull. These conditions have been associated with environmental factors such as a restrictive intrauterine environment, premature birth, birth trauma and more recently, sleep position.

In 1992, the American Association of Pediatrics published a position on the relationship between Sudden Infant Death Syndrome (SIDS) and infant sleep positions: suggesting that infants be placed in the supine position for sleep in order to reduce the risk of SIDS. Following this recommendation was an

increase in the number of infants in the United States presenting to physicians with craniofacial deformities, primarily positional plagiocephaly with associated facial asymmetry.

Positional plagiocephaly and brachycephaly are remarkably similar to anterior-posterior intentional artificial cranial vault deformation or external cranioplasty as seen in many archaeological populations throughout the world.

Anthropometry offers tools by which infant skeletal patterns of growth, both normal and abnormal, can be quantified. Infants that underwent dynamic orthotic cranioplasty were monitored using anthropometric techniques. Measurements were selected for this study that best reflect morphological variation in the cranial and facial skeletal structures. Analysis of clinical anthropometric data are used to explore the distinctive craniofacial characteristics of these infants and to compare this unique condition with the archaeological records.

Domestic assault: soft tissue and skeletal manifestations. S. A. NOVAK, Department of Anthropology, University of Utah, Salt Lake City, UT 84103

Domestic assault occurs cross culturally at variable frequencies. Interpersonal violence is also readily apparent in primate colonies, occurring between and within the sexes. We should therefore expect that domestic assault occurred in the past and is observable in the osteological record.

This study questions whether domestic assault exhibits a predictable injury pattern in soft tissue that can be distinguished from accidental injury, and also whether these patterns are reflected in the skeleton. With the establishment of these patterns, the temporal depth of domestic assault can be explored more explicitly in the osteological record.

In this study, injuries received in modern domestic assault cases were used to create body maps to assess soft tissue damage and determine which bones were most likely affected. Two hundred cases of domestic assault were collected each from the Salt Lake City Police Department and the Bradford Royal Infirmary (BRI), UK casualty unit. Two hundred accidental injuries were also collected from the BRI as a control group to assess the differences between assaults and accidental injuries. Each injury was coded for type of wound (blunt, sharp, etc.), soft tissue manifestation (contusion, abrasion, stab, etc.), whether the bone was affected, and what weapon was used. To keep comparisons with the past valid, assault and accident cases were discarded if they used or resulted from modern machinery (car, gun, etc.).

Results of the study suggest that there are distinct patterns of injury attributed to domestic assault which vary significantly from accidental injury. The face and

head are primary target during domestic assault which differs from appendicular injuries acquired during accidents. Further, these injuries are expressed in a pattern on the skeleton that should allow differentiation in the skeletal record.

Supported by Marriner S. Eccles fellowship.

Male behavior in extragroup encounters: an example of the collective action problem? C.L. NUNN, Department of Biological Anthropology and Anatomy, Duke University, Durham, NC 27705.

Primate taxa differ in the extent to which males participate in extragroup encounters. For example, in some species males use loud calls or visual displays during extragroup encounters involving other males, while in other species these displays are less prominent or absent. Individual males also differ in their responses to extragroup males, with dominant males usually taking a more aggressive role.

In order to examine variation in male extragroup conflict, I compiled a database on encounter frequency and escalation, male displays, and the presence of male loud calls. This database was then used to test whether a social factor involving the "collective action problem" can account for variation in male responses to intruders. Like a collective good in economics, the benefits of extragroup mate defense are potentially shared by all males in a social group. Hence, it might benefit some males to adopt a "free-rider" strategy, where participation in aggressive extragroup encounters is provided at a reduced level (Hawkes 1992; Heinsohn & Packer 1995; van Schaik 1996). If this economic principle applies to evolutionary forces acting on species differences, then extragroup conflict is predicted to be less common in species where the benefits of mate defense (fertilizations) are more equally shared (e.g. under scramble competition).

In order to test this hypothesis, I examined male territoriality relative to the type of intrasexual competition experienced by males. Male-male competition was assayed by (1) canine dimorphism (a substitute for contest competition) and (2) relative testes size (a substitute for scramble competition, which is associated with multiple breeding males in the social group). As predicted by collective action models, male aggressive extragroup encounters are less common in situations of high scramble competition. I consider how females might benefit by altering male intrasexual competition through its effect on collective action in males. I also discuss additional factors that can influence male extragroup aggressive behavior, including kinship and cooperation.

Reproductive hormones and pregnancy-related sickness in a prospective study of Bangladeshi women. K. A. O'CONNOR, D.J. HOLMAN, E. BRINDLE, S.H. BARSOM, J.W. WOOD. Pennsylvania State University, University Park, PA 16802.

Pregnancy-related sickness (PRS—nausea, vomiting, food aversions in early pregnancy) has been hypothesized to be an

adaptation that protects an embryo from maternally ingested toxins during the sensitive first trimester of pregnancy. To test this idea it is critical to understand the mechanisms involved in PRS. However, the causes of PRS remain unknown. High levels of reproductive hormones in early pregnancy have been considered the most likely causes of nausea and vomiting. Of the limited research (10 studies) examining the relationship of hormones with symptoms, all have been clinical, single- or double-interview/hormone sample studies, and there is no consensus of results. In this paper we evaluate the relationship of 3 reproductive hormones across gestation with the presence and absence of symptoms of PRS, using prospective data across gestation for a large population-based sample of women.

The hormonal and epidemiological data are from an 11-month prospective study of rural Bangladeshi women in 1993. Twice-weekly interviews and urine samples were collected from 203 women followed across gestation (8,000 paired interview/urine samples). Hormone levels were determined from the urine samples using enzyme immunoassays. Estrogen levels were estimated using an assay specific for the metabolites estrone-3-glucuronide, free estrone and estrone-3-sulfate; progesterone levels were estimated using an assay specific to the metabolite pregnenediol-3-glucuronide; and human chorionic gonadotropin levels were estimated with an assay specific to intact, β -subunit, and β -core fragment hCG. A logistic regression model, with and without lag effects, was used to estimate the effects of each hormone on the probability of experiencing each symptom of PRS (nausea, vomiting, food aversion, smell aversion). Maternal age and parity were included as covariates.

Results from a subsample consisting of 560 paired interview/hormone observations for 15 women followed from conception to birth suggest that higher levels of hCG are associated with the presence of each symptom of PRS. Lower values of an estrogen/progesterone ratio are associated with a higher probability of food and smell aversions, but are unrelated to nausea and vomiting. These effects are independent of maternal age or parity.

This work was supported by NSF (DBS-9218734 and SBR-9600690), NICHD (2P30HD28263-06), NIA (2T32AG00208-06), Mellon Foundation, American Institute for Bangladesh Studies and Hill Foundation grants.

Rethinking the evolution of the human hand. J.C. OHMAN, The University of Liverpool, UK, and R.P. MENSFORTH, Cleveland State University, Cleveland, OH 44115.

The human hand is unique among living hominoids, and has been traditionally described as possessing a relatively robust and long thumb. However, relative thumb robusticity is problematic because, in at least some measures, humans and gorillas possess similarly robust thumbs. Moreover, while it is fundamentally true that humans possess a relatively long thumb, this morphological paradigm masks the more accurate assessment that rays II - V are relatively more short than the thumb is relatively long. In other words, instead of being concerned about relative thumb length per se, we should ask when and why rays II - V became relatively short.

There are two other, but less well documented, features in which the human hand is exceptional. First, the presence of paired sesamoid bones in the peri-articular capsule of all metacarpophalangeal joints is highly conservative in

mammals. However, these sesamoids are absent in gorillas and orangutans, and rarely present in chimpanzees. Humans are differentially unusual in always possessing paired sesamoids in the first metacarpophalangeal joint, often a single, radial side sesamoid in the second metacarpophalangeal joint, and commonly a single, ulnar side sesamoid in the fifth metacarpophalangeal joint. Second, the proximal joint surface of the first proximal phalanx is more circular in apes, but more elliptical (mediolaterally broad) in humans.

Human hand morphology has commonly been interpreted as one that facilitates precision grips during tool-making behaviors. While some traits (i.e., ability to hyperextend the first distal phalanx) likely pertain only to precision grips, most precision grips are low load behaviors, and the suite of features described above are better explained as adaptations to increased loads. Moreover, evidence from the Pliocene species *Australopithecus afarensis* indicates a shift toward at least some of these adaptations occurred before the earliest known evidence for stone tools. Therefore, we suggest that we should look beyond stone tool-making as a reason for the acquisition of the pollex dominated fully pentadactyl power grip.

Middle Meningeal Vessel Pattern Expression in Rabbits with Nonsyndromic Congenital Coronal Synostosis. V.D. O'LOUGHLIN¹, A.M. BURROWS², T.D. SMITH², M.P. MOONEY³, H. W. LOSKEN³ and M.I. SIEGEL³. (¹Medical Sciences Program, Indiana University, Bloomington, IN 47405, ²School of Physical Therapy, Slippery Rock University, Slippery Rock, PA 16057, ³Dept. of Anthropology, University of Pittsburgh, Pittsburgh, PA 15260.)

Craniosynostosis has been shown to affect ectocranial growth. The effects of craniosynostosis on the endocranium and the endocranial vasculature are just beginning to be explored. Previous studies with sagittal synostotic skulls found that middle meningeal vessel impressions were altered greatly. However, it is unclear whether similar vessel impression alterations are found in skulls exhibiting different forms of craniosynostoses.

In the present study, adult New Zealand white rabbits were used to examine the effects of nonsyndromic coronal synostosis on the middle meningeal vasculature. Silicone rubber endocasts were prepared from the skulls of 23 normal rabbits and 14 rabbits with coronal synostosis (5 bilaterally and 9 unilaterally synostosed). Width, depth, convolution and direction of the anterior and posterior branches of the middle meningeal vessels were examined qualitatively. Vessel impressions were compared between the normal and synostosed endocasts using Kruskal-Wallis Oneway ANOVA statistical tests.

Results indicate that coronal synostosis affects middle meningeal vasculature. In particular, the ANOVA data showed that the anterior branches often left deeper impressions in coronal synostosed skulls. Posterior branch impressions were not significantly different between the two groups. In fact, posterior vessel impressions were very similar between the two groups. These findings suggest the anteriorly-placed growth restrictions from coronal synostosis may similarly restrict anterior branch vasculature, resulting in the altered vessel morphology.

Supported in part by NIDR (DE10830), Plastic Surgery Education Foundation, and Central Research Development Fund, University of Pittsburgh.

Sexual dimorphism in latitudinal variation in the body mass index. B.L. O'NEIL, University of Tennessee, Knoxville, TN 37996-0720.

The body mass index (BMI, weight in kg/height in m²) is used in many clinical and anthropological contexts to compare individuals' or groups' body weights relative to their heights. Previous researchers have cited high BMI values as evidence of "Bergmann's Rule" or "cold adaptation" in high latitude populations, though the relationship between climate and BMI *per se* has not been tested.

This study tests whether the BMI and sex differences in mean BMI values are correlated with latitude in 52 worldwide populations. Male BMI is highly significantly correlated with latitude, as is the difference between male and female means. Female BMI is weakly correlated with latitude. In warmer latitudes, females' BMI tend to be higher than males'; in colder latitudes, males' BMI tend to exceed those of females, revealing a previously undescribed pattern of sexual dimorphism.

Latitudinal clines in BMI are compared with those for weight, height, and SA/V. Geometric modeling, after Ruff (1994), shows that the BMI varies inversely with the SA/V ratio.

Overall, it appears that while both males and females in colder latitudes are larger and have lower SA/V ratios than their tropical counterparts, such trends are weaker in females. The interaction of these trends explains the sex differences in clinal BMI variation. Since reproductive allometry may present greater constraints on the upper bounds of female body size, these results suggest that height- and mass-related sexual dimorphism may have increased as *Homo* sp. migrated out of Africa to colder climates due to this limiting effect on female body size.

The Quantitative Genetics of Dermatoglyphics: Variances, Covariances, and Developmental Integration. S.D. OUSLEY, Department of Anthropology, Smithsonian Institution, Washington, DC 20560.

Many anthropologists believe that dermatoglyphic variables are especially valuable for investigations of

population structure due to their early development *in utero*, high heritability, and selective neutrality. Holt firmly established the idea that dermatoglyphic traits are highly heritable with little environmental or nonadditive variation based on analyses of a composite dermatoglyphic trait, TRC (Total Ridge Count). Other dermatoglyphic investigators have found significant genetic dominance. However, the quantitative genetics of dermatoglyphics has not been adequately investigated in a multivariate framework. Results from factor analysis of individual finger counts strongly suggest "field effects" influencing the embryonic formation of epidermal ridges.

A large dermatoglyphic sample, with pedigree data from over 800 German and Austrian families, was analyzed using the method of maximum likelihood estimation. For individual finger ridge counts, univariate heritabilities ranged from .5 to .7, and multivariate heritabilities were between .2 and .5. However, very high intercorrelations among variables indicated a high degree of developmental integration for dermatoglyphic traits. Additionally, significant dominance and "field effects" were detected.

The high estimated heritability for TRC is an artifact of summing counts from fingers which have low repeatabilities. Lower heritabilities for traits are not a great concern in studies of population structure if the additive variance-covariance matrix is proportional to the phenotypic variance-covariance matrix. However, this is not true for dermatoglyphic traits. The genetic integration of dermatoglyphic traits is much higher than the phenotypic integration due to finger-specific dominance and environmental effects. As a result, the analysis of dermatoglyphic traits will produce a distorted picture of the genetic relationships between populations and more statistically significant distances.

Sex and death in the ancient world: comparing paleodemographic and inscriptional data. R.R. PAINE, Department of Anthropology, University of Utah, Salt Lake City, UT 84112, G.R. STOREY, Department of Classics, University of Iowa, Iowa City, IA 52242, and J.L. BOLDSSEN, Institute of Community Health, University of Odense, DK-5000, Odense C, Denmark.

Reconstructing demographic patterns from periods before the keeping of vital records is a difficult undertaking. This paper compares mortality patterns derived from two data sources, excavated skeletons and Roman funerary inscriptions in an attempt to assess the degree of confidence we should place in either one.

Age-at-death data from skeletal samples and from funerary inscriptions have both received considerable (and often justified) criticism. Critiques of paleodemographic data (e.g. Bocquet-Appel and Masset, 1982 *J. Hum. Evol.* 11:321-333) are well-known to physical anthropologists. Critiques of Roman funerary epigraphy (e.g. Hopkins, 1966, *Pop. Stud.* 20:245-264) focus on two issues: 1) whether individual inscription

ages are accurate; and 2) whether a sample composed of those individuals commemorated by inscriptions is representative of the entire Roman population.

The skeletal data (N = 8,165) were compiled from existing site reports and more widely published data. They include aged and sexed adult individuals (3,783 females; 4,382 males) from more than 100 European sites dating from the Mesolithic through the early Middle Ages. The Roman funerary inscription data (N = 2,237) are from the computer-generated indices of the CIL 6, part 7, fascicle 5, section 1 "Vocabula (T-Z)." These data include CIL number, sex of dedicatee, and age at death in years, months, days.

Survival analyses based on both data sets suggest that females had significantly greater mortality risk, during their reproductive years, than males throughout the period between the adoption of agriculture and the early modern period. Criticisms of this type of comparison have been made for both skeletal (Walker 1995, in Saunders and Herring, eds. *Grave Reflections*, Canadian Scholars' Press, Toronto) and inscriptional data (Hopkins 1966). However, the level of agreement between the two data sets suggests that each must be taken seriously, despite potential problems.

Characterizing Emergence in Hominid Evolution. A.M. PAUKOVICH Krasnow Institute, George Mason University

Complex adaptive systems theory, self-organization and hierarchical processes are among the ideas that have joined co-evolutionary models in recent evolutionary thinking. Culture as a component of evolutionary and dual inheritance models has been variously explored. Two key structural features stand out in these ideas of dual inheritance -- the asymmetries between genetic and cultural inheritance and the role of rules in the encoding of both biological and cultural information. However, it has also been argued that complexity when viewed from a hierarchical framework tends to array behaviors vertically. Thus, asymmetries in rates between hierarchical levels tend to isolate these behavioral phenomena from each other. Concerns about scale, information content, and organization in addition to hierarchy have also raised questions about how culture can be identified behaviorally as an "emergent" properties. Critical to such an emergence is how a system is structurally reintegrated in order to support a new, more complex level of organization. I argue that our understanding of hominid evolution in light of characterizing culture as an emergence must distinguish between object hierarchy and hierarchical process. In addition, the configurational complexity of behaviors (i.e. irregular arrays or asymmetries) are independent of their differentiation. This suggests that evolutionary selection is necessarily coupled with self-organizing properties. Thus, to claim culture as an "emergent" process, we must first explore and specify the relationships among hierarchy, self-organization and complexity in hominid evolution.